



Neuroentrepreneurship: state of the art and future lines of work

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Abstract

This study aims to conduct a literature review and examine key research topics within the field of neuroentrepreneurship, categorizing works based on this classification and specifying different directions of research lines. Additionally, it seeks to compile definitions and their evolution regarding the concept of neuroentrepreneurship, contributing a new proposal. The methodology involves identifying keywords related to main themes and their direct relation to all research works encompassed in the entrepreneurship spectrum. Research articles matching the query are extracted from the Web of Science (WoS) and Scopus databases, as they provide a comprehensive citation search and access to multidisciplinary research, adhering to established inclusion-exclusion criteria. Findings allow the classification of contributions to the literature into four themes: Neuroscience and entrepreneurship, the use of neurotechnologies in entrepreneurship research, the neurological profile of the entrepreneur, and ethics in neuroentrepreneurship. Lastly, this study emphasizes its originality by presenting a set of works directly related to neuroentrepreneurship, establishing a classification based on four thematic research lines in neuroentrepreneurship. This allows extracting a limited set of definitions for the concept, classifying them based on themes incorporated in the definition. Finally, the authors provide a comprehensive definition of neuroentrepreneurship, tailored to the four major research blocks in this discipline.

Keywords Neuroentrepreneurship · Neuroscience · Entrepreneurship · Neurotechnologies · Entrepreneur · Emotions

Extended author information available on the last page of the article

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Introduction

Neuroentrepreneurship has gained relevance since 2009, focusing on the crucial influence of brain function on business decisions (Korpysa, 2020). Although there is an emerging literature that combines research in neuroscience and entrepreneurship, definitions and relationships have not yet reached complete consolidation. The field of neuroentrepreneurship encompasses various areas of research (Sharma et al., 2021), such as the examination of brain regions involved in the decision-making process (simultaneously processing risks and reward opportunities for business success), the different cortical activations leading to successful business decisions, and how entrepreneurial orientation fosters the recognition, evaluation, and exploitation of opportunities for improved decision-making. Entrepreneurship is defined as human activities aimed at discovering previously unexplored business opportunities, along with the human capacity to take risks (Saura et al., 2023). The ability to act, especially in the face of risks and uncertainties, adapt to a dynamic environment, and maintain internal motivation, is crucial for an entrepreneur to play their role consistently and effectively in the market.

Neuroscience emerges as a key tool in understanding business decisions, as well as in the identification and creation of opportunities (Massaro, 2015), supported by biometric techniques such as electroencephalography (EEG) and galvanic skin response (GSR). It is essential to explore the role of emotions in business decisions since various systems influence risk-seeking and risk-avoidance. The inappropriate suppression or activation of these systems can lead to errors in decision-making (Peterson, 2007). The reward system is activated when perceiving a potential gain and extends to the nucleus accumbens of the limbic system, where dopamine is also located, reaching the medial prefrontal cortex. In contrast, the loss avoidance system, less defined in the brain, involves the amygdala and the anterior insula of the limbic system. Consequently, neuroscience provides answers to numerous questions about the origin and evolution of entrepreneurship.

This work is an attempt to fill the gap in research on the concept of neuroentrepreneurship. The role of factors such as entrepreneurship, risk, uncertainty, neuroscience, biometrics, or reward systems is investigated, analysing the evolution of neuroentrepreneurship. This article can be considered a review of the neuroentrepreneurship literature as it articulates the value proposition by attempting to provide a concrete definition of the concept.

The paper is structured as follows: key themes characterizing neuroentrepreneurship in the literature are examined, and the works are grouped based on this classification, specifying the different directions of research lines. Next, the most comprehensive definitions are extracted, trying to refine the approach, and finally proposing a definition more adapted to the key themes addressed. The implications of these analyses are discussed in the final part of the article with the aim of providing a concrete definition of the neuroentrepreneurship concept. Finally, possible directions for future research are discussed.

Methodology

The interaction between neuroscience and entrepreneurship is illustrated by the manifestation of the innate characteristics of entrepreneurial personality (Nicolau & Shane, 2014). Figure 1 represents the search and selection process used in this review. First, keywords related to the main topics are identified and transformed into a Boolean query. For instance, “entrepreneur*” is directly associated with all research within the field of entrepreneurship. From the neuroscience perspective, the keyword used is “neuro*”. Second, research articles matching the query are extracted from the

	Database:	Web Of Science
	Boolean:	Title = (neuroentrepreneur*) Records generated after Query: 4 Topic = (neuroentrepreneur*) Records generated after Query:8 Title = (neuro*) AND (entrepreneur*) Records generated after Query: 47 Topic = (neuro*) AND (entrepreneur*) Records generated after Query: 302
Search	Total different records generated after Query: 294	
	Final records reviewed: 27	
	Database:	Scopus
	Boolean:	Title, Abstract, Keywords = (neuroentrepreneur*) Records generated after Query: 15 Title = (neuro*) AND (entrepreneur*) Records generated after Query: 411
	Total different records generated after Query: 396	
	Final records reviewed: 1	
	Exclude:	
	Document types:	Book Review, Proceedings paper, Correction and Book Chapters
	Language:	Non-English Research Papers
Selection	Papers related to:	Antidepressants, Entrepreneurship Education, Entrepreneurialization of Motherhood, Professional Profiles, Neurodegenerative Diseases, Neurosurgery, Neuroticism, Neural Network, Human Neurotransmitter, Receptors, and Neurodiversity
	Papers included within Web Of Science Database	
	Total final records reviewed (WOS and Scopus): 27	

Fig. 1 Review Search and Selection Process. Last Revision Date: November 2023. Source: Prepared by the Authors

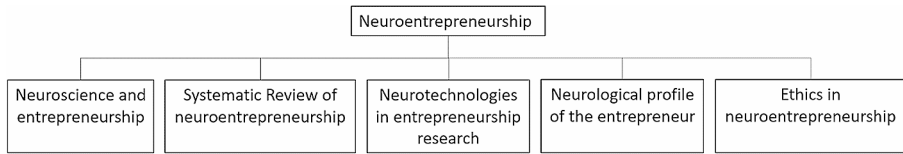


Fig. 2 Classification of Reviewed Papers. Source: Prepared by the Authors

Boolean: Title = (neuroentrepreneur*) or Topic = (neuroentrepreneur*)						
Position	Author	Total citations	Title/ Topic	Journal (ISSN)	Author's country of origin	Author's home university
1	Nicolaou, N. (2014)	37	Topic	JMI (1056-4926)	England	University of Warwick
2	de Holan, PM. (2014)	26	Title	JMI (1056-4926)	Qatar	HEC Paris in Qatar
3	Sharma, GD. (2021)	14	Title	ERD (0898-5626)	India	GGs Indraprastha University
4	Joseph, GC. (2023)	2	Topic	JEEE (2053-4604)	India	Cochin University Science & Technology
5	Liu, WW. (2022)	1	Topic	FP (1664-1078)	USA	University of Chicago

Boolean: Title = (neuro*) AND (entrepreneur*) or Topic = (neuro*) AND (entrepreneur*)						
Position	Author	Total citations	Title/ Topic	Journal	Author's country of origin	Author's home university
1	Hodgkinson, GP. (2009)	143	Topic	LRP (0024-6301)	England	University of Manchester
2	Hayton, J. (2012)	128	Topic	ETP (1042-2587)	England	Newcastle University
3	Ryff, CD. (2019)	98	Topic	JBV (0883-9026)	USA	University of Wisconsin Madison
4	Shane, S. (2020)	46	Topic	ISBJ (0266-2426)	USA	Case Western Reserve University
5	Nicolaou, N. (2014)	37	Title	JMI (1056-4926)	England	University of Warwick

Fig. 3 Most Cited Authors. Source: Prepared by the Authors

Web of Science (WoS) and Scopus databases, chosen for their comprehensiveness in citation searches and access to multidisciplinary research (Paul & Criado, 2020). Third, all extracted articles undergo inclusion-exclusion criteria (see Fig. 1).

The 31 selected articles reviewed in this study are available as an online appendix, categorized by topics (according to our organizational framework in Fig. 2).

Statistically, the most cited authors are shown in Fig. 3, classified based on the search criteria, indicating the year, journal, country of origin, and university of the author.

Neuroentrepreneurship: neuroscience tools in entrepreneurship analysis

This section aims to elucidate the potential of neuroentrepreneurship and its domains of application. To achieve this, a categorization of factors inherent to neuroentrepreneurship has been proposed to identify key aspects for a clarifying definition presented in this article.

Application of neuroscience to entrepreneurship

It is crucial to highlight the potential role of neuroscience in the field of entrepreneurship, as the traditional approach to the study of entrepreneurship focuses on understanding how entrepreneurs think and make decisions, with limited knowledge about the neural foundations involved. Research addressing entrepreneurial decision-making from the conception of the business to all the events triggering these decisions provides new evidence on the interaction of neurological processes in the entrepreneurial decision-making process (Shane & Nicolaou, 2013). Research on cognition in entrepreneurship is experiencing a boom, with studies multiplying significantly, emphasizing both business knowledge and neuro-businesses (Heydari et al., 2020). A key factor for the acceptance of neuroscience by entrepreneurship researchers has been the understanding that experts think differently than novices. How experts become experts is reflected in the development of an “expert scenario”: a cognitive mechanism that understands key elements in a decision situation and the probable order of events (Hodgkinson et al., 2009). Neuroscience has crucial potential for the future of entrepreneurship research. Nicolaou et al. (2019) propose four complementary mechanisms through which neuroscience can contribute to entrepreneurship theory and research: (1) Capture hidden mental processes that cannot be investigated through other techniques; (2) Inform about the discriminant and convergent validity of entrepreneurship; (3) Examine the antecedents and temporal order of entrepreneurship variables; (4) Refine and decide between different theoretical perspectives in a way that behavioural data cannot achieve. However, the limitations and ethical implications of a neuroscientific approach to entrepreneurship must be considered. It is identified that the heuristics underlying entrepreneurs’ decisions are linked to various cognitive biases and emotions, resulting in specific patterns of behaviour. For example, successful leaders often excel because they take decisive actions to overcome their weaknesses through self-discipline, seek external advice, and maintain flexibility to change their attitude and perspectives (Joseph et al., 2023).

Research in neuroscience is perceived as a valuable and anticipated addition to the field of entrepreneurship (Nicolaou & Shane, 2014). Breugè (2017) presents a neurocognitive model that explores the neural foundations of opportunity discovery and creation, highlighting the importance of brain activation in entrepreneurial opportunities. This model seeks to unify conceptual frameworks of discovery and creation, arguing that whether opportunities are discovered or created, the activation of brain structures plays a crucial role in their formation. Recent research in various fields, such as cognitive psychology, social cognition, neuroscience, and neurophysiology, suggests that dual processes involving affect and cognition significantly influence judgment and decision-making (Hayton & Cholakova, 2012). Simultaneously, studies in the field of entrepreneurship demonstrate a growing interest in the psychological well-being of entrepreneurs (Ryff, 2019). Therefore, entrepreneurship emerges as a conducive field for research in neuroentrepreneurship, providing a comprehensive insight into the cognitive processes that drive “entrepreneurial thinking”. Neurosciences are relevant to entrepreneurship research, as the incorporation of neuroscientific methods and technologies can enrich the understanding of phenomena studied in entrepreneurship that invoke the entrepreneur’s mind. Especially, emerging technolo-

gies exploring entrepreneurial cognition and emotions can provide a deeper understanding (de Holan, 2014). However, caution must be exercised in any collaboration between social neuroscience and entrepreneurship, as entrepreneurship researchers have worked hard to legitimize entrepreneurship as an independent academic research area (Tracey & Schlupeck, 2014).

This approach represents a novel perspective in business literature, establishing links with self-regulation theory and contributing to the emerging body of knowledge on neuroentrepreneurship, which analyses entrepreneurial cognition, decision-making, and entrepreneurial behaviour.

Systematic review and bibliometric analysis

There is a scarcity of literature reviews addressing the integration of neuroscience and entrepreneurship, exploring the concept of neuroentrepreneurship and research in this field through scientific methods (Liu et al., 2022). Using the keywords “neuroscience” and “entrepreneurship” or “neuroentrepreneurship,” a review was conducted in two academic databases: Social Science Citation Index and Science Citation Index, accessible through the Web of Science website. The results of this study provide a guide to describing the theoretical connection between neuroscience and entrepreneurship. Furthermore, emerging literature is observed that converges from neuroscience and entrepreneurship research. Sharma et al. (2021) analyses literature trends examining the interrelationships between neuroscience and entrepreneurial intention through six approaches: molecular neuroscience, systems neuroscience, behavioural neuroscience, cognitive neuroscience, social neuroscience, and computational neuroscience. In this review, five factors impacted by entrepreneurial intention are identified, including opportunity recognition, risk assessment and taking, entrepreneurial cognition, entrepreneurial behaviour, and entrepreneurial decision-making.

Finally, other studies focus on the role of individuals in the innovation management process, particularly leaders and associated behaviours. Entrepreneurial Leadership (EL) emerges as a crucial field in innovation management, becoming increasingly multifaceted and interdisciplinary in its evolution (Cucino et al., 2021). This study identifies five promising groups of research areas, such as the organizational, biological, cognitive, and emotional focus, and highlights five future research themes, including dynamic capabilities in the innovation exploitation process, the human aspect of leadership, leadership construction, the biological perspective of leadership, and the application of neuroscience in the ecosystem.

Use of neurotechnologies in entrepreneurship research

Neurotechnologies are defined as the application of techniques and tools grounded in neuroscience to investigate and gain a deeper understanding of human behaviour, including entrepreneurial behaviour. In the field of entrepreneurship research, neurotechnologies such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) are employed to examine brain activity while entrepreneurs engage in specific tasks related to entrepreneurship (Becker et al., 2011). This approach provides insights into the cognitive and emotional processes linked to

entrepreneurial decision-making. Neuroscience aids in understanding how entrepreneurs assess risk and make decisions, unveiling patterns of brain activation associated with risk perception, with substantial implications for strategic decision-making. Another potential research avenue is the detection of emotional responses in specific entrepreneurial situations, including assessing emotional responses to failure or success, providing valuable information about resilience and entrepreneurial motivation. Creativity, essential in entrepreneurship, can be analysed through neurotechnologies to comprehend brain activity related to generating creative ideas and problem-solving, useful for understanding and fostering entrepreneurial creativity.

The use of biometric neuroscience techniques to understand entrepreneurial mindset is a relatively unexplored area with the potential to identify areas of the brain responsible for risk-reward systems in an entrepreneurial brain. Understanding entrepreneurial behaviour from a neuroanatomical perspective is also a limitation, as the role of neurotransmitters in decision-making is established in neuroscience. Although advances in neuroscience technology, such as wireless EEG, have gained popularity among management and entrepreneurship researchers, neuroscience, and functional neuroimaging are just beginning to open new opportunities to explore the neurophysiological substrates of mental processes and corresponding behaviours. Despite few empirical advances in the entrepreneurship literature, pilot testing and the use of more cost-effective imaging approaches, such as EEG-based studies, can be valuable to capture information about manipulated conditions and protocols used, as well as facilitate dialogue among research participants (Massaro, 2015). Clear challenges for entrepreneurship scholars seeking to research neuroimaging involve the interdisciplinary nature of the work, disparate knowledge bases, and asymmetric incentive systems for neuroscience and entrepreneurship academics. As an alternative to empirical studies, users may receive Sensorimotor Rhythm (SMR) and Beta neurofeedback (Rahmati et al., 2014), allowing for the enhancement of entrepreneurial traits. Other studies seek to explain entrepreneurship from the brain-based entrepreneurial approach (Dincer Aydin et al., 2023), examining, through electroencephalography (EEG), creative thinking and opportunity recognition—two characteristics often used to define entrepreneurs. This has led to findings indicating differences in brain activity between entrepreneurs and non-entrepreneurs during creative thinking and opportunity recognition, including the observation of different neural networks in the brains of entrepreneurs, especially during opportunity recognition.

Building on consumer engagement and neuroscience literature, some studies have used inter-subject correlation of electroencephalography (EEG-ISC) to explore how entrepreneurial passion influences consumers' neural engagement (Yu et al., 2022). Strong passion and preparedness activated left and right prefrontal regions of consumers' brains, which could influence their engagement. Functional neuroimaging has the potential to enrich the study of entrepreneurship, and this interdisciplinary research area can be leveraged in business research (Massaro et al., 2023). Despite calls, functional magnetic resonance imaging (fMRI) brain studies are relatively scarce in business research. Ooms proposes a methodology based on the use of rs-fMRI to observe the brain in the absence of cognitive tasks or stimulus presentation (Ooms et al., 2023), offering benefits to enhance understanding of the entrepreneurial mind compared to task-based functional magnetic resonance imaging. Through this

methodology, it has been demonstrated that habitual entrepreneurs exhibit greater functional connectivity between the insula (a region associated with cognitive flexibility), and the anterior prefrontal cortex (a key region for exploratory choice) compared to managers, suggesting that this increased connectivity could promote flexible behaviour.

Entrepreneur's neurological profile

The neurological profile of the entrepreneur addresses the characteristics and patterns of brain activity that could differentiate those involved in entrepreneurial activities. Although research in this field is ongoing, and there is not universally accepted “entrepreneurial neurological profile,” some studies suggest relevant aspects, such as decision-making, creativity, motivation and resilience, empathy, social skills, and future focus. It is essential to note that research in this area is still evolving, and entrepreneurship is a complex activity involving a variety of personal and environmental factors. Additionally, individual differences are significant and can override generalizations based on brain activity. The use of technologies like functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) has allowed researchers to explore the relationship between brain activity and entrepreneurial behaviour. However, more research is needed to fully understand how neuroscience relates to entrepreneurship. Passion drives entrepreneurial action, and passionate entrepreneurs often liken their businesses to their own children (Sinha, 2022). Research focuses on how entrepreneurial passion can lead to addiction, analysing the pleasure-pain pathway regulated by dopamine. This approach reveals how, in the constant pursuit of pleasure, an individual can become addicted to entrepreneurship due to their initial passion.

To better understand how neurodiversity (neurobiological/brain-related differences) relates to entrepreneurial cognition, Moore et al. (2021) point out that entrepreneurs with ADHD employ a more intuitive cognitive style, demonstrating higher levels of entrepreneurial alertness and RICH, with no significant differences found in metacognition. In creative industries, entrepreneurs' creativity is the driving force behind entrepreneurial activities (Gao et al., 2020). On the other hand, the key to entrepreneurial success lies in individual entrepreneurial orientation (EOI). Finally, Baskaran et al. (2021) investigate the relationship between multiple intelligences (MI) and entrepreneurial opportunity recognition, analysing to what extent each dimension of MI acts as an activation driver for entrepreneurial opportunity recognition. The work proposes research based on the synthesis of literature on MI and entrepreneurial opportunity recognition, developing a conceptual framework explaining the multidimensional relationship of MI with such recognition, with neuromarketing perception acting as a mediator to enhance the predictive value of the proposed framework and provide additional insights into the factors fostering entrepreneurial opportunity recognition.

Ethics in neuroentrepreneurship

The use of neurotechnologies in entrepreneurship research raises ethical challenges, similar to other research fields, including concerns about privacy and appropriate interpretation of results. Therefore, adhering to ethical and methodological principles when applying these technologies is crucial. Ethics in neuroentrepreneurship is fundamental as it involves the use of information and technologies related to the human brain, with potential significant implications for privacy, informed consent, and potential risks to mental health (Moss & Amadio, 2019). Key ethical considerations in neuroentrepreneurship include informed consent from participants or users, privacy and data security of collected information, as well as transparency in the collection, storage, and use of neuroscientific data. Entrepreneurs, facing uncertainty and risk, pursue their goals with the conviction that it is the only way to achieve real innovation (Maiques, 2019). Their vision is often driven by the desire to have a positive impact on people's lives. Addressing the misuse of technology and its ethical implications, entrepreneurs often claim to follow ethical principles, as their primary mission is to contribute to a better world. The key question they face is how the technology will ultimately be used.

Over the last decade, neurotechnology has shifted from being primarily the domain of research centres and medical facilities to reaching millions of professionals, patients, and consumers worldwide. This is due to the proliferation of low-cost, non-invasive, and scalable technologies that can assess and/or enhance brain and mental health (Fernandez, 2019). Neuroscience and its findings raise new ethical questions that are not fully addressed by traditional bioethics. Neuroethics emerges to address and respond to the ethical, legal, and social issues related to the changing landscape of neuroscience. Moss et al. (2021) employ empirical ethics methods to assess the perceived value and attitudes of neuroentrepreneur toward neuroethical issues, analysing how these align with the neuroinnovation process. Their work identifies key themes and procedural weaknesses in the neurotechnology innovation process, aiming to raise awareness and provide viable steps to advance and accelerate neuroscience with social impact.

Proposal for the definition of neuroentrepreneurship

Having identified the main lines of work of neuroscience and its impact on entrepreneurship in the previous sections, we now present the organizational framework for defining the concept of neuroentrepreneurship for future research agendas. The work is based on classifying the provided definitions, relying on four of the highlighted themes in Sect. 3: Neuroscience and Entrepreneurship, the use of neurotechnologies in entrepreneurial research, the neurological profile of the entrepreneur, and ethics in neuroentrepreneurship.

There are only a few definitions of the concept of neuroentrepreneurship, with one notable example being that of De Holan (de Holan, 2014), who specifies that the concept of neuroentrepreneurship suggests the underlying premise for studying entrepreneurship with brain functioning. The integrative vision of neuroentrepreneurship

extends to the cognitive effort involved in knowledge, intention, and entrepreneurial mindset. This definition focuses on two of the five themes raised: Neuroscience and Entrepreneurship and the Neurological Profile of the Entrepreneur. Boudreaux et al. (2019) understand the term neuroentrepreneurship as an extension of the term entrepreneurship, to include the cognitive science approach to decision-making by considering entrepreneurial mindset and heuristic theories. This definition focuses on two of the five themes raised: Neuroscience and Entrepreneurship and the Neurological Profile of the Entrepreneur.

Marshall et al. (2019) consider neuroentrepreneurship as the identification of cognitive mechanisms that can empower entrepreneurs to make decisions more quickly and effectively. This definition focuses on one of the five themes raised: Neuroscience and Entrepreneurship. Massaro (2020) explains that within neuroentrepreneurship, the realization of entrepreneurial decision-making in the creation and recognition of opportunities can be unravelled through neuroscience. This definition focuses on one of the five themes raised: Neuroscience and Entrepreneurship. Sharma et al. (2021) explain that the concept of neuroentrepreneurship suggests the underlying premise for the study of entrepreneurship with brain functioning. This definition focuses on one of the five themes raised: Neuroscience and Entrepreneurship. Finally, Dincer Aydin et al. (2023) specify that neuroentrepreneurship seeks to explain entrepreneurship within the framework of a brain-based entrepreneurial approach. This definition focuses on one of the five themes raised: Neuroscience and Entrepreneurship.

Below is the implication, by themes, of each neuroentrepreneurship definition (Table 1). As can be observed, primarily all definitions aim to establish a relationship between the knowledge of neuroscience and entrepreneurship, with only a few definitions contributing aspects related to the neurological profile of the entrepreneur.”

Based on these definitions and the literature related to neuroentrepreneurship published to date, it is possible to provide a definition that encompasses all the themes covered in the analysis. We can consider the following contribution as a definition of neuroentrepreneurship:

Table 1 Conceptualization of neuroentrepreneurship definitions based on the themes in which they have been explained. Source: Prepared by the authors

Author	Paper	Neuroscience and entrepreneurship	Neurotechnologies in entrepreneurship research	Neurological profile of the entrepreneur	Ethics in neuroentrepreneurship
De Holan	de Holan, 2014	X		X	
Boudreaux	Boudreaux et al., 2019	X		X	
Marshall	Marshall et al., 2019	X			
Massaro	Massaro, 2020	X			
Sharma	Sharma et al., 2021	X			
Dincer	Dincer Aydin et al., 2023	X			

Neuroentrepreneurship is a research discipline that seeks to analyse the neurological processes involved in the entrepreneurial decision-making process, utilizing neurotechnologies (techniques and tools) to investigate and better understand entrepreneurial behaviour. This allows for the identification of characteristics and patterns of brain activity that could distinguish individuals engaged in entrepreneurial activities, following ethical and methodological principles in the application of these technologies, given the significant implications in terms of privacy and informed consent.

Conclusion

The article has underscored works related to neuroentrepreneurship, emphasizing the crucial relationship between neuroscience and entrepreneurship. This was achieved through the review and classification of 31 articles focusing on the interface between neuroscience and entrepreneurship. The study has unveiled that the primary themes within neuroentrepreneurship include neuroscience and entrepreneurship, systematic review and bibliometric analysis, the use of neurotechnologies in entrepreneurship research, the neurological profile of the entrepreneur, and ethics in neuroentrepreneurship. Regarding each of these themes, it is evident that the relationship between neuroscience and entrepreneurship is an emerging field seeking to comprehend how brain process's function and how they influence entrepreneurial behaviour. Neuroscience, concentrating on the study of the nervous system, including the brain, aims to comprehend how brain functions impact thinking, emotions, and decision-making. Literature reviews in this area are scarce, given its emergence in entrepreneurship research. The use of technologies such as neurotechnology, including brain-computer interfaces, holds practical applications in the business realm, ranging from enhancing cognitive performance to optimizing decision-making. The study of the neurological profile of the entrepreneur is also in its early stages, with research focusing on characteristics and patterns of brain activity associated with cognitive and emotional functions relevant to entrepreneurship. Indeed, entrepreneurs are likely to make decisions using a personal cognitive framework formed over time through the interactions of various contextual and psychological variables, including characteristics, traits, and personal attitudes (Acharya & Berry, 2023). Even in the current era of digitization, entrepreneurs have easy access to information with just a click, engaging in activities such as purchasing products, exchanging opinions publicly, and utilizing various online functions. This provides them with significant advantages for successful actions according to their personality types and relevant success in their business projects (González-Padilla et al., 2023). Lastly, ethics in neuroentrepreneurship pertains to the consideration and application of ethical principles in the context of entrepreneurial initiatives related to neuroscience. Given that neuroentrepreneurship involves the application of neuroscientific knowledge and technologies for product or service development, addressing key ethical issues is crucial. The integration of neuroscience into entrepreneurship research not only presents challenges but also opens new opportunities for understanding and enhancing entrepreneurial behaviour, decision-making processes, and ethical considerations in the evolving landscape of business and technology.

Statistically, the most cited works refer to the concept of neuroentrepreneurship itself, the integration of neuroscience in the field of entrepreneurship, literature reviews aimed at expanding and refining the broad concept of neuroentrepreneurship, and the behavioural patterns of entrepreneurs. By countries, the most active in this new research discipline are England, the United States, and India. The number of citations is limited, but the number of publications is increasing, with over 75% of the publications concentrated in the last five years.

This review has suggested the grouping of definitions of neuroentrepreneurship, and their classification based on the thematic areas they cover, providing a new, more comprehensive definition that encompasses all the proposed topics. In this way, it is possible to consider neuroscientific research for improving decision-making, productivity, creativity, and other aspects relevant to business success, applying neuroscientific findings to better understand how cognitive, emotional, and decision-making processes work in the human brain. This knowledge can be used to develop more effective business strategies, improve leadership, optimize individual and collective performance, and address specific challenges within the business environment. Practical applications of neuroentrepreneurship can include designing work environments that foster concentration and creativity, implementing leadership strategies based on an understanding of brain dynamics, and developing products or services that leverage neuroscientific principles to enhance the user experience.

As part of the practical implications, the article suggests addressing as many topics as possible in the proposed works to consolidate neuroentrepreneurship as an expanded discipline in entrepreneurship research. Therefore, the practical use of the results will have a global character, and the utilization of results in terms of articles, presentations, and conference notes can go beyond the scope of entrepreneurs. Companies can use this research to improve their set of business skills and better recognize opportunities within the business.

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